

REMARKS

Attorney for Applicants has carefully reviewed the outstanding Office Action on the above-identified application. Applicants have amended the application, as set forth herein, and respectfully submit that the application, as amended, is in condition for allowance.

Claims 2-11 and 19-20 were indicated in the Office Action as containing allowable subject matter. The Office Action rejected claims 2, 4, and 28 under Section 112, second paragraph. Applicants have amended claims 2, 4, and 28 to overcome this rejection. Specifically, claims 2 and 28 were amended so that the term "its" was removed from these claims and replaced with the term "an electric field vector." Further, claim 4 was amended to clarify that the orientation of the first electric pulse is varied between first and second orientations, and that the orientation of the second electric pulse is varied between third and fourth orientations. With these amendments, Applicants respectfully submit that claims 2, 4, and 28 are in condition for allowance.

Applicants' claimed invention relates to a method and apparatus for fractionating charged macro-molecules, such as DNA, using asymmetric electric fields applied to a matrix of obstacles. The present invention provides a method of continuously fractionating charged macro-molecules comprising the steps of: **loading molecules into a matrix of obstacles; applying an asymmetric electric field to the matrix to separate the molecules according to size along a horizontal direction of the matrix; and collecting separated molecules at a plurality of locations along a bottom edge of the matrix.** (Claim 1)

The present invention also provides a method of continuously fractionating charged macro-molecules comprising the steps of: **loading molecules into a matrix with an array of obstacles; applying to the matrix electric fields whose amplitudes are constant in time; varying field orientations of the electric fields with time to create an asymmetrical electric field to separate the molecules according to size along a horizontal direction of the matrix; and collecting separated molecules at a plurality of locations along a bottom edge of the matrix.** (Claim 18)

Additionally, the present invention provides an apparatus for continuously fractionating charged macro-molecules comprising: **an array of obstacles; asymmetrically alternating electric fields applied to the array of obstacles to separate molecules according to size along a horizontal direction of the array; and a plurality of locations along a bottom edge of the array for collecting separated molecules.** (Claim 27)

Applicants respectfully traverse the rejections raised in Office Action of claims 1, 12, 15-19, 21, 24-40, and 42-46 as being unpatentable over U.S. Patent No. 6,027,623 to Ohkawa. Reconsideration is respectfully requested.

Ohkawa discloses a device and method for electrophoretic fractionation of molecules in a fluid medium using a plurality of obstacles arranged on a substrate in rows and columns. Each obstacle includes inclined walls with respect a fluid channel, and a uniform electric field can be applied to the device. As molecules diffuse through the device, the walls of the obstacles re-

direct the molecules back into the same fluid channel. Faster-diffusing, smaller molecules migrate through the channel first, followed by slower-diffusing, larger molecules.

Ohkawa fails to teach or suggest each element of Applicants' claimed invention as set forth in independent claim 1. Specifically, Ohkawa fails to teach or suggest providing a method of continuously fractionating charged macro-molecules comprising the steps of **loading molecules into a matrix of obstacles; applying an asymmetric electric field to the matrix to separate the molecules according to size along a horizontal direction of the matrix; and collecting separated molecules at a plurality of locations along a bottom edge of the matrix,** as set forth in claim 1. As pointed out in Applicants' response to the previous Office Action, Ohkawa fails to teach or suggest separating molecules according to size along a horizontal direction of the matrix. The present Office Action fails entirely to address this argument, and does not point to any corresponding structure in Ohkawa. As such, Applicants respectfully submit that independent claim 1 and all claims depending therefrom, which contain all of the limitations of independent claim 1, are patentable over Ohkawa.

Likewise, Ohkawa fails to teach or suggest each element of Applicants' claimed invention as set forth in independent claim 18. Specifically, Ohkawa fails to teach or suggest providing a method of continuously fractionating charged macro-molecules comprising the steps of **loading molecules into a matrix with an array of obstacles; applying to the matrix electric fields whose amplitudes are constant in time; varying field orientations of the electric fields with time to create an asymmetrical electric field to separate the molecules according to size along a horizontal direction of the matrix; and collecting separated molecules at a plurality**


of locations along a bottom edge of the matrix, as set forth in claim 18. Accordingly, Applicants respectfully submit that independent claim 18 and all claims depending therefrom, which contain all of the limitations of independent claim 18, are patentable over Ohkawa.

Moreover, Ohkawa fails to teach or suggest each element of Applicants' claimed invention as set forth in independent claim 27. Specifically, Ohkawa fails to teach or suggest providing an apparatus for continuously fractionating charged macro-molecules comprising **an array of obstacles; asymmetrically alternating electric fields applied to the array of obstacles to separate molecules according to size along a horizontal direction of the array; and a plurality of locations along a bottom edge of the array for collecting separated molecules**, as set forth in claim 27. Therefore, Applicants respectfully submit that independent claim 27 and all claims depending therefrom, which contain all of the limitations of independent claim 27, are patentable over Ohkawa.

All issues raised in the Office Action are believed to be addressed. Claims 2, 4, and 28 were amended. Claims 1-12, 15-21, 24-40, and 42-46 are pending in this application, and are believed to be in condition for allowance. No new matter is believed to have been added. Re-examination is requested and favorable action solicited.

Respectfully submitted,

Dated: 5/24/04


Michael R. Friscia
Reg. No. 33,884
Attorney for Applicant
Wolff & Samson PC
One Boland Drive
West Orange, NJ 07052
Tel.: (973) 530-2024
Fax.: (973) 530-2224